Advanced Repeater Systems
Radio Interface Adapter Kit
Installation and Operation Instructions

Overview

The Advanced Repeater Systems Radio Interface Adapter kit provides the repeater builder, radio technician or engineer with a unique interface circuit for connection of virtually any audio source to another radio, repeater, controller or operation console. The Adapter can receive audio from almost any source and generates a Carrier Operated Switch (COS) and Push-to-Talk (PTT) outputs with an adjustable hang time, and has an adjustable audio delay, so no audio is lost. Audio delay time is settable from 50 to over 250 milliseconds. The transmitter key line is an open-collector, pull-to-ground, 2N2222 transistor capable of up to 500 mA current sink. The Adapter has four status LEDs; green for power, red to indicate active COS or transmitter key, blue indicates receive audio and red indicates radio PTT. The board operates from 9 to 15 volts DC at less than 30 mA.

The Radio Interface Adapter kit is intended for an experienced technician. The installation requires soldering skills, electronics knowledge, interconnect wire and schematic of the interface connector. The board is designed to be installed with double-faced foam tape.

The Adapter can be supplied with two, 3.5 mm, four conductor jacks and a 8 pin connector or with 3 input/output solder pad connectors for direct hardwire connections:

J31 is the main radio or transceiver connector with four wires on Pins: 1) Ground, 2) Rx (Spk) Audio Input, 3) PTT, 4) Tx Audio Output (Mic).

J32 is the secondary radio connector for use as a repeater transmitter with three wires on Pins: 1) Ground, 2) no connection, 3) PTT, 4) Tx Audio Output (Mic).

J33 is the main interface and power connector for connection to a repeater controller, transmitter or control console with eight wires on Pins: 1) Power input 8 to 15 volts DC; 2) Ground; 3) COS High Output; 4) PTT or COS low output, open-collector; 5) Audio Output; 6) Tx Audio Input; 7) open-collector Tx Key Input; 8) logic-high Tx Key Input.

Theory of Operation

Reference the Adapter schematic and layout. U31 provides the regulated 5 volts required for the Adapter's integrated circuits. U32 is a dual operational amplifier configured as a Voice Operated Switch (VOX). Pin 2 is biased slightly above Pin 3. Input audio applied to Pin 2 causes Pin 1 to go high at the audio rate, lighting D33, charging C36, and causing Pin 5, 6 and Logic High Output (COS) to go high, lighting D34 and turning on Q31, pulling PTT to ground. When the input audio ceases, C36 is discharged through R47 and the transmitter hang-time adjustment potentiometer R48. When the voltage on Pin 5 falls below Pin 6, Pin 7 and COS output go low, D33 and Q31 turn off.

U33 is a digital audio delay integrated circuit which digitizes the analog audio input via level adjustment potentiometer R53, clocked through a shift register, then converter back to analog. The amount of audio delay is controlled by the clock oscillator potentiometer R54.

Q32 is the radio transmitter key transistor with input on J33-8. If an open-collector driver is available from a repeater controller or console, use input J33-7. D35 is the active transmit red LED which is pulled up via R61. If the transmitter key is affected by the supply voltage supplied through this LED, cut top lead of R61.

The Adapter can be used in a variety of set ups including a portable radio interface, a mobile radio interface, a link radio adapter, a cross radio system adapter, and a repeater maker, among others. Regardless of application the connection to the radios is similar, the exception being some amateur portable radios, which combine a pull down Tx Key and Tx audio. In these applications R51 and R60 may be installed. The values vary depending on the manufacturer; Icom uses 4.7k and Yaesu use 2.2k.

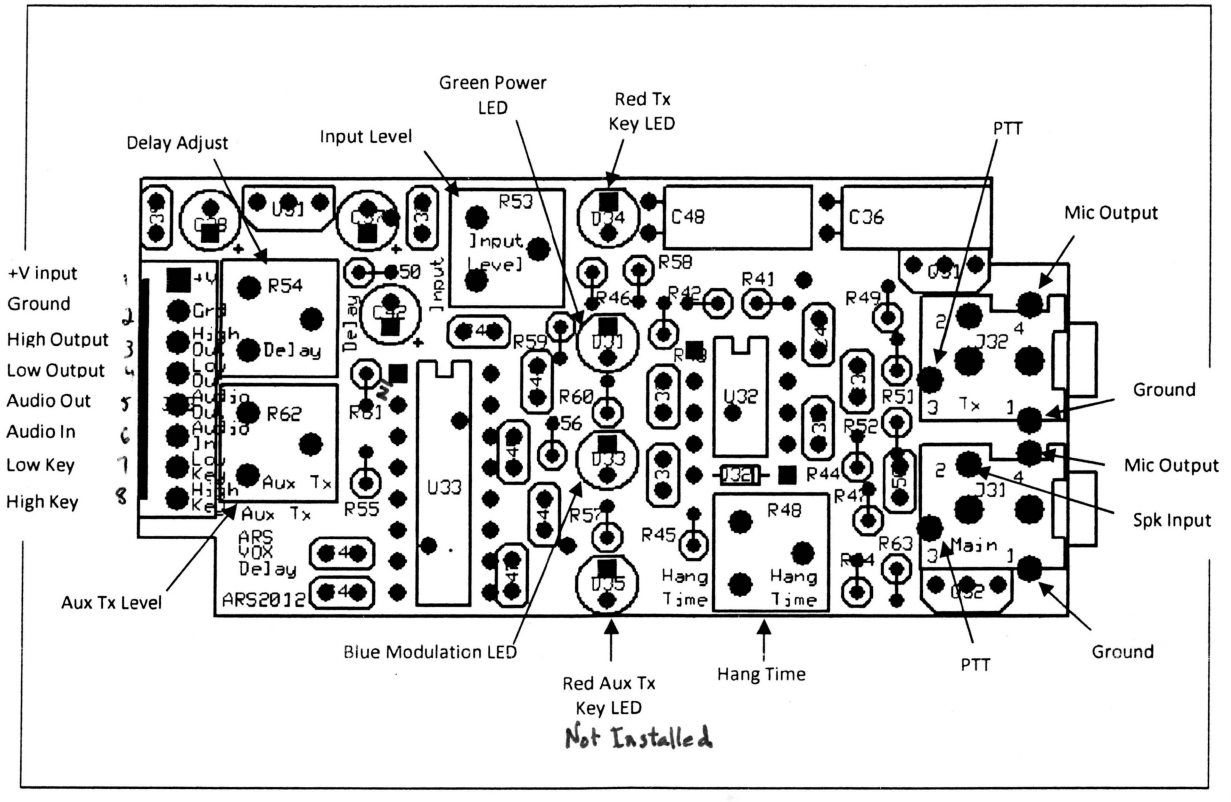
Copyright Advanced Repeater Systems 2012

Installation

1. Identify a suitable location for the Adapter board and wiring away from RF fields.
2. Reference the Adapter schematic and board layout to identify connection points for power, ground, PTT, logic high output (COS), Audio Input, and Low and High Key Input.
3. Power off the interface equipment. Install small gauge wires from the interface to the pads marked on the Adapter (reference the board drawing) to the radio and interface (controller, repeater, etc.) device.
4. Radio connections should be made with radio connects such as through speaker/microphone connectors on portable radios (available from ARS). Mobile radios usually have squelched receive audio available on a ¼" speaker jack or accessory connector. Tx key (PTT) and Tx Audio are available connected on the microphone connector and sometimes on the accessory connector. Some microphone inputs are high impedance and may require a series resistor (10k - 75k) to minimize hum and overdrive.
5. J31-1 is the main radio or transceiver ground
6. J31-2 is the main radio speaker audio input. Level should be between 1 to 4 $V_{pk\text{-}pk}$
7. J31-3 is the primary transceiver PTT, pull to ground
8. J31-4 is the main radio transmit audio (microphone) input
9. J32-1 is the Tx Radio ground
10. J32-2 is not used
11. J32-3 is the Tx Radio PTT, pull to ground
12. J32-4 is the Tx Radio transmit audio (microphone) input
13. J33-1 is the board power and should be a clean or regulated voltage between 8 and 15 volts
14. J33-2 is the board ground and should be as short as possible and connected to a low impedance point
15. J33-3 is the logic high output has 1k ohm impedance with a high level of approximately 4 volts and a low of approximately 1 volt, an active audio input causes this output to go high
16. J33-4 is the transmitter key (PTT) output is an active low, pull-to-ground capable of 500 mA current sink
17. J33-5 is the delayed audio output should be to a high impedance point such as a microphone input, repeater controller audio input or similar circuitry
18. J33-6 is the audio input should be de-emphasized audio, Tx level set by R62
19. J33-7 is for an open collector, active-low, pull to ground PTT, typically from a controller or console
20. J33-8 is for an active high PTT, greater than 2.5 volts
21. Insulate the board from the repeater chassis with a piece of paper or cardboard.
22. Turn on the power and verify that the green power LED is lit.
23. Unsquelch the receiver, the blue and red LEDs should light. Set the receiver volume to approximately 1/3 and adjust the Input Level potentiometer R54 for a clean audio level to the transmitter, repeater controller or console.
24. If using a transceiver on the main radio connector provide a PTT signal from the interface and adjust transmit audio level with R62.
25. Set the desired Audio Delay Time with R54.
26. Set the desired Hang Time with R48.
27. When you are satisfied with the performance of the Adapter, secure it with double-faced tape, and route and secure the wiring away from RF circuits.
28. Installation complete.

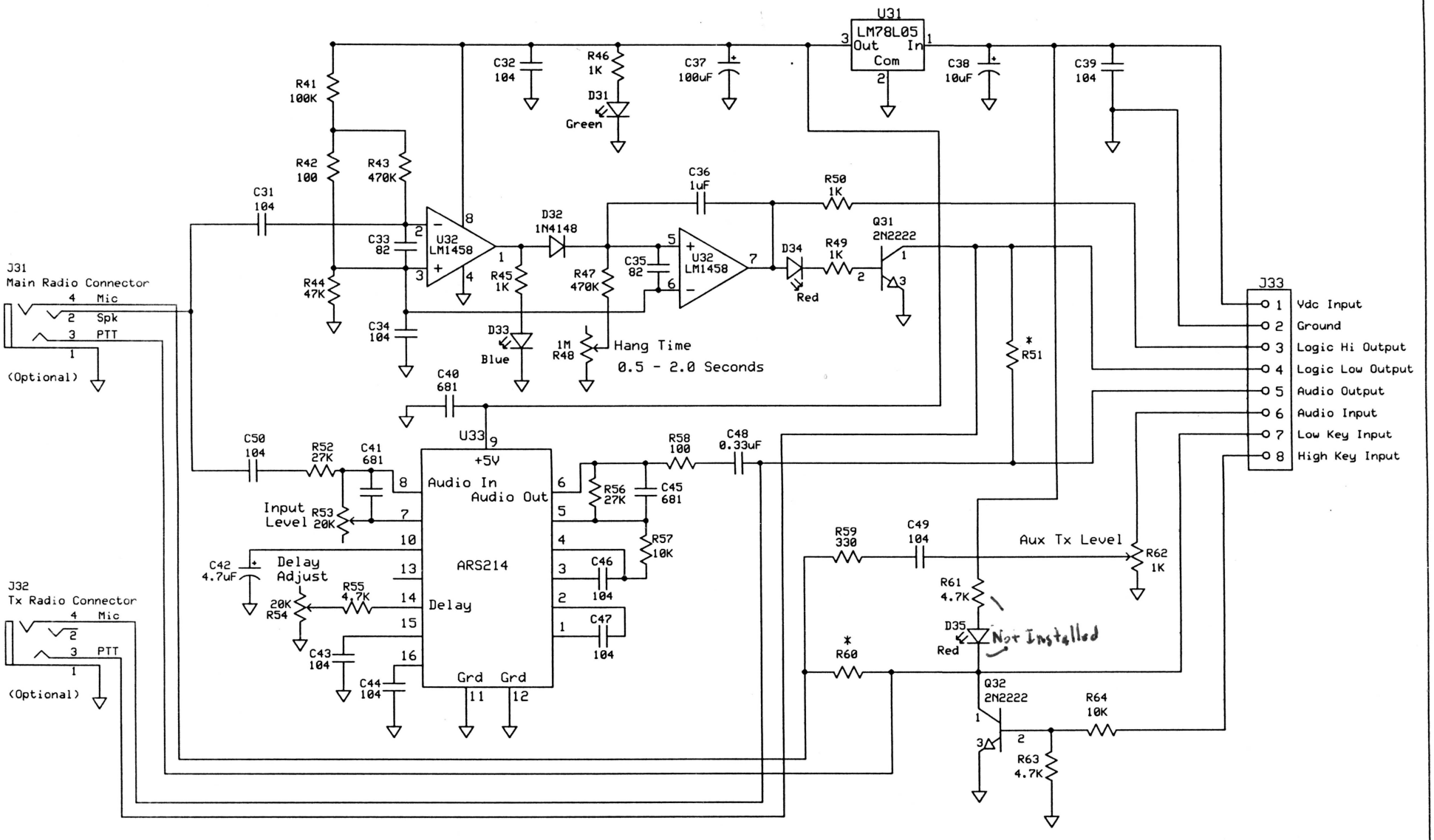
Copyright Advanced Repeater Systems 2012

Radio Interface Adapter
Board Layout



Copyright Advanced Repeater Systems 2012

ARS Radio Interface Adapter



Notes:

Added C50

* R51, R60 Tx Key/Tx Audio Resistors: 2.2k for Yaesu, 4.7k for ICOM

Copyright Advanced Repeater Systems 2012

Advanced Repeater Systems		
Radio Interface Adapter		
M. Bush	Rev 1.1 4/20/2012	Page 1 of 1